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REPORT

TO THE

MASSACHUSETTS HIGHWAY COMMISSION

BEING AN ANSWER TO

THREE QUESTIONS

ASKED BY THE COMMISSION,

GROWING OUT OF THE INVESTIGATION

OF THE

NEW ENGLAND TELEPHONE AND TELEGRAPH COMPANY

MADE TO THE COMMISSION

BY

DUGALD C. JACKSON

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Massachusetts Highway Commission

Hon. WILLIAM E. McCLINTOCK, Chairman
Hon. HAROLD PARKER
Hon. JOHN H. MANNING

A. B. FLETCHER, Secretary

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1908.

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9-21-55

D. C. & WM. B. JACKSON
ENGINEERS, EXPERTS
CHICAGO. BOSTON

BOSTON, MASS., March 10, 1908.

To The Honorable Massachusetts Highway Commission, Boston, Massachusetts.

GENTLEMEN: — I have given the questions set forth in your letter of instructions dated January 21st, careful consideration; I have conferred with your Honorable Board, with the officers of the New England Telephone and Telegraph Company, and with others interested in the telephone problem of Massachusetts; and have considered the now available data bearing upon the subject matter of your questions.

Your letter of instructions lays down three questions which you wish me to answer at this time. These questions are:

1. Is an appraisal of the plant of the New England Telephone and Telegraph Company necessary before any satisfactory solution can be had of the general problem of what should be the equitable rates for service of said company throughout its Massachusetts territory, and, if so, how should such inventory and appraisal be made and what would be the probable cost of the same?
2. Without prejudice to the general problem of what should be the equitable rates for service of the New England Telephone and Telegraph Company throughout its Massachusetts territory, and in the absence of a complete inventory and appraisal of the plant of said company, is it possible to reduce the toll rates now in force in the Boston and Suburban division for toll business into and out from the so-called Metropolitan exchanges, and if such a reduction may be so made upon what basis should it be effected?
3. With the same premises as stated in Question 2, in order to improve the quality of the service given by the New England Telephone and Telegraph Company, is it possible and is it advisable to change at the present time the multi-party lines in the Boston and Suburban division to lines having not more than two subscribers thereon with the so-called "divided ringing" appliances?

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The first two questions relate particularly to the proper adjustment of rates of charge for telephone service, while the third question relates more particularly to means for improving certain classes of service. However, the question of adequate service is so inseparably connected with that of proper rate adjustment, that the one cannot be divorced from the other, and both must be kept constantly in mind in the course of formulating the answer to each of the three questions.

There are so many independent variables affecting the problem of the equitable adjustment of telephone rates, that it is one of the most complicated problems in the realm of rate-making. A full appreciation of the many factors entering into the problem is requisite to enable one to intelligently answer, or, in fact, to fully understand, the questions at issue.

The commercial telephone art has developed from nothing to its present importance in no more than a generation, and it is still far from having reached a stable condition of development. The Commission of Engineers which made a comprehensive report in 1907, formulated after extended investigation of the telephone situation in Chicago, made the following introductory statements regarding the characteristics of the telephone rate problem:

> "A telephone company in a large city must face a problem in many respects more complex than that of any other public utility corporation. The water department is called upon to sell a single commodity, namely, water, and at prices which are fixed with comparative readiness. The gas company also is called upon to sell a single commodity, metered for nearly every customer, and its conditions in dealing with customers are relatively simple. It may sell some additional by-products, as coke, tar and ammonia, but the quantities and market values of these are readily arrived at. The traction company has a more complex problem than some of the other purveyors of public utilities, but even here the price paid by the several patrons is uniform and the substantial difference between patrons lies only in the lengths of the rides which they may choose to take.

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"The telephone problem, on the contrary, involves many complexities, partially caused by the relatively large number of classes of service which the telephone company must offer to its patrons for the purpose of fully developing the telephone service of the city, and partially by the intangible character of the electric medium with which the telephone business is carried on, the delicacy of the apparatus used, and the wide differences in the manner and extent of the use of the apparatus by the various subscribers.

"If a telephone company properly extends the telephone service in the city, it must be prepared to take care of the requirements of a range of patrons as wide as the interests of the city itself, including the largest business organizations, the hotels, the newspapers, the professional men, the small business houses, and residences of all classes. It must provide apparatus for the service of each class of patrons which will enable it to furnish the service to each subscriber at an appropriate price within his means. It is desirable for the prices to be graded so that the largest user shall not pay less than his fair share of the expense of maintaining the traffic and the remuneration to the company for its investment, and equally so that the smaller user may get his telephone service at a price which is within his means and yet is reasonably remunerative to the company for its outlay.

"Telephone service has been of remarkably rapid development and extension in this country. Less than fifteen years ago there was no telephone exchange system with as many as 10,000 subscribers served by the system. At that time the number of telephones in Chicago was considerably under 10,000.....
The rapid expansion of the telephone service began in Chicago in 1900, and approximately two years earlier in New York.

"Prior to the time when the rapid increase in the number of telephones began, the telephone art had been steadily changing, and the increased rate of expansion of the telephone service began approximately coincidently

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with the introduction into the great cities of the modern so-called 'common battery' method of telephone operation. The prior apparatus used for telephone service was more expensive to operate and maintain, less convenient for the user, and not adapted for the extended use to which the telephone is now put in the large cities, — all of which prevented the telephone service from becoming fully developed. The subscribers were not as well satisfied with the service which could be afforded them by the older apparatus and it was also necessary to charge higher prices.

"During the recent period of tremendous growth which has followed the introduction of the 'common battery' method of operation, accompanied by a service of greater convenience and lower prices, the telephone companies of the larger cities have been practically submerged in an effort to keep ahead of the demands of the people for additional telephones, and the problems relating to classification of service and appropriate charges for different classes of service have not been worked out in a suitable manner. The telephone companies have apparently been fully engaged in the extension of their business and the extension and improvement of their plants, and they have not found men or time to work at the details of operating economies and the best methods of handling the service of different classes of subscribers in the way that railroads, traction companies, electric light companies and various other public utility companies have been working out the details of economies relating to their processes of operation.

"The telephone business is not only an unusually complex one, but the records of the existing telephone company doing a large business in Chicago are lacking in details which are needful for the fixing of specific scales of charges for different classes of service. We have endeavored to obtain data bearing on the cost of specific classes of telephone service from other telephone companies, including the Bell Telephone Companies of New York and elsewhere and also from certain of the so-called Independent telephone companies, but in no instance

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have we been able to obtain records kept in such detail or in such manner as to afford appropriate data for fixing rates, and in every instance the rates seem to have been dictated by estimates based on experience or the requirements of business expediency, instead of being founded on a knowledge of the cost of the different classes of service. The telephone companies seem to go on the belief that their business is satisfactory if the total results of each year's business show a profit, and that it is unsatisfactory if the year's business does not show a profit, and they have heretofore apparently neglected to consider more than superficially the essential question whether the rates charged deal fairly by the different classes of subscribers.

"The telephone art is by no means stable. In most of the well developed lines of industry, the art is on an advance but is advancing at a substantially stable rate. This is the condition, for instance, of the railroad art. No unforeseen or unanticipated revolutionary changes are momentarily expected to occur in the railroad art on account of discoveries or inventions, but the telephone art is different. The telephone service is now expanding at its tremendous rate largely on account of the introduction of the common battery system of operating telephones, and other improvements of more or less revolutionary character are likely to be introduced into the telephone art from time to time for decades to come."

The foregoing quotation shows that the Chicago Commission of 1907 found the telephone problem in that city one of great complexity, and that the data necessary for taking rate-making out of the realm of simple business expediency was then lacking. The problem of telephone rates before your Honorable Body is even more complex than Chicago afforded, as it includes the contrasting complexities of service in a large city, service in many smaller cities, service in villages and rural communities, and the service known as toll service through which the various central points are enabled to communicate with each other.

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Illustrating this fact, I will point out that the Boston and Suburban district with an estimated population of 1,300,000, is provided with as many different classes of service with their corresponding rates as are now provided in the City of Chicago to serve the needs of 2,500,000 people; while the number of additional classes of service with their corresponding rates, which are provided throughout the rest of the Commonwealth of Massachusetts, are very numerous.

Before an equitable division between classes of service can be made of the charges and expenses that comprise the aggregate expense of giving service to customers of so many varieties or classes, each of which is served at its individual rates, it is necessary that a careful study shall be made of cost of plant, for the purpose of duly distributing and allotting the cost to the different classes of service, and that an equally careful study shall be made of the telephone traffic now handled and of its rate of growth in the different parts of the State.

There are a number of independent factors which must be considered, as each has its influence upon the proper adjustment of rates. These factors include the character of construction and equipment required to take care of the service in the different portions of the Commonwealth, which are served by the operating company's system, the relative density of traffic in the different portions, the extent and character of toll traffic from district to district which may be cultivated, the load factor of the traffic, etc., etc. By load factor, I mean the ratio of the average number of messages conveyed per hour during the year to the number conveyed in the busiest hour of the exchange. This gives a measure of the completeness with which the subscribers utilize the plant which their maximum rate of use requires the company to provide.

Question 1.

Your first question normally sub-divides itself into three closely related parts, as follows:

(*a*) Is an appraisal of the plant of the New England Telephone and Telegraph Company necessary before any satisfactory solution can be had of the general problem of what

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should be the equitable rates for service of said company throughout its Massachusetts territory?

(*b*) In the event of an affirmative answer to the foregoing, how should such inventory and appraisal be made?

(*c*) What would be the probable cost of the same?

(*a*)

As already stated, the telephone business has been one of marvelously rapid growth, and most telephone companies have not organized their record keeping in a way which is compatible with determining the true cost of furnishing a rapidly expanding and shifting service. In fact, many companies have been so fully occupied in constructing plant to care for the increasing demand for their service, that they have apparently not given the cost of individual classes of service any considerable thought. The usual rates for telephone service are determined by experience or as the result of business expediency rather than from a consideration of the costs that actually enter into supplying the service. The New England Telephone and Telegraph Company is no exception. It has, like other companies, been called upon to meet a rapidly increasing demand for service, and it has also grown to its present magnitude partly through consolidations or accretions of smaller telephone systems which apparently had preserved only the meagrest records. The company therefore does not possess investment records, service cost records, or traffic records, which would enable it to adjust rates on a basis of the actual cost of supplying the service.

Secretary Longley of the New England Telephone and Telegraph Company concisely presented the conditions regarding investment records in a letter to Mr. A. R. Patterson, which I find on pages 17 & 18 of the printed copy of the report to your Honorable Body made by Mr. George Albree. Secretary Longley therein says:

> "There has never been any attempt at separation of the old classifications of construction when new classifications were adopted. It would have been impossible to make such separation except from inventories of the plant, which have never been made.

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> "The result of this system of evolution is that the books of this Company today do not furnish an accurate record of the various classes of construction, and no such record could be compiled from any records at hand."

The rates heretofore made by the New England Telephone and Telegraph Company are presumably based on the extended experience of officials who may be presumed to have the best interests of the company and its subscribers at heart; but it is undeniable that the rates heretofore made have been founded only on individual judgment and business expediency, and no better foundation can exist until a well planned appraisal of the plant has been made, and fuller traffic records have been gathered. I understand it to be the desire of your Honorable Body to have before you an exhibit of costs of service in order that rates may be made on a sounder basis of equity than simple judgment and business expediency afford, and I am unable to see any plan by which this result can be accomplished without first obtaining a detailed appraisal of the company's plant throughout the Commonwealth. This appraisal should be made according to districts outlined with full consideration of traffic characteristics. The appraisal should also extend to the whole of the operating company's property, but need not be sectionalized or carried to so much detail beyond the limits of the Commonwealth. The costs for buildings, exchange equipment, distributing lines (overhead and underground), subscribers' stations, etc., must be segregated for each district. The cost of the distributing lines must be still further divided between trunk lines and subscribers' primary lines; and a separation should be made of the toll lines from the subscribers' lines, as far as practicable.

My conclusion that an appraisal is necessary before grounds can be found for rate-making on a basis of cost instead of a basis of expediency, seems to be concurred in by Mr. George Albree, who reported to your Honorable Body. I will quote from page 4 of the printed copy of his report, putting certain portions in italics:

> "In the first place, which ever of the courses is determined later best to meet existing conditions, you will be

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confronted with the fact that, whether treating the Company as a unit or as an aggregate of units, *the three elements, cost of plant, cost of its maintenance and cost of operation, are yet to be determined.*

"My investigation has shown me that only the third factor, namely cost of operation, can be obtained with any degree of accuracy from the books of the Company submitted for my inspection."

An inventory and appraisal, such as I recommend, will represent the entire property of the telephone company as it now stands, and it will be unnecessary to have further general inventories of the property made in the future. By keeping correct construction, depreciation and renewal records and costs, and by their proper application, the telephone company can always maintain the general inventory as a true record of its property, from which the investment costs that enter into the various classes of service may be obtained at any time.

I will add that fuller records of traffic and study of traffic conditions are necessary before the cost of operation can be reasonably apportioned between classes of service, and traffic studies should be carried on while the appraisal is under way.

(*b*)

Part (*b*) of your first question is:

How should such inventory and appraisal be made? (Part (*a*) being answered in the affirmative.)

The work of making a proper inventory and appraisal of the telephone company's property may be carried out in either of three different ways:

1. A competent firm of consulting engineers, employed by the Highway Commission for the purpose, might assume the entire work of making schedules of property and fixing suitable values thereon, utilizing, as far as practicable, the existing records of the Company. The plans for the work would in this event be made up by the consulting engineers in consultation with your Honorable Body and the telephone company.

2. The Highway Commission might carry on the work with a force of employees gathered directly under its own employ;

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but this would thrust into the office of the Highway Commission all the minor details of organization relating to a large temporary force of employees who would have to be drilled into their work, and special quarters for carrying on the work would have to be provided in addition to the present offices of the Commission. Besides which, consulting engineers would have to be employed to advise in the making of plans and in directing the progress of the work.

3. The work might be executed by the telephone company through its own employees, in consultation with engineers employed by the Highway Commission, by whom the plans for the work should be approved and who would keep in constant touch with the progress of the work so as to be able to verify and certify its accuracy.

The third method seems to me most suitable for your purpose. By placing the responsibility of making the property schedules upon the telephone company, all records which the Company now possesses can be most readily and quickly made available, and the required field data can be collected by the company's men more promptly than perhaps could be expected of men who were unfamiliar with the plant. The telephone company's employees who are familiar with the plant in each district can, with reasonable accuracy and despatch, make the inventories for their districts. As rapidly as these inventories are completed, they can be quickly and accurately verified on the ground by the Highway Commission's consulting engineers, who would also verify the Company's book records of property as far as necessary to determine their substantial accuracy.

The appraisal of the value of the plant given in the schedules should rest largely with the engineers employed by the Highway Commission, but this part of the work can also be greatly facilitated by enlisting the co-operation of the Company for the purpose of making its records most fully available.

In view of all of the considerations, it is my opinion that this method of obtaining a complete inventory and appraisal of the telephone property, namely, through the agency of the telephone company itself, co-operating with consulting engineers employed by the Highway Commission, who check and

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verify all results, is the one that will afford a satisfactory accomplishment with the least expenditure of time and money.

Whatever method for making the inventory and appraisal is adopted, it is essential that complete and detailed plans for the work shall be laid out before the taking of the inventory is begun, so that the desired classification and segregation of the different elements and parts of the system may be, as far as possible, automatically accomplished as the work progresses. If this precaution is not adopted, the completed inventory will not attain its greatest value, and it may be rendered almost valueless so far as a basis for future rate adjustment is concerned.

(*c*)

Making the inventory in this way would place upon the telephone company the burden of overcoming many of the annoying difficulties of executing the work, and would relieve the Highway Commission of much of the expense. Experience in various appraisals made by my firm (D. C. & Wm. B. Jackson) and acquaintance with the cost of appraisals made for the State of Michigan, the State of Wisconsin, and the City of Chicago, lead me to estimate at between $50,000. and $60,000. the total cost of an inventory and appraisal of the property of the telephone company suitable to the purpose of your Honorable Body.

With the telephone company executing the details of the work, the Highway Commission is relieved from that part of the expense, but must be prepared to bear the expense of making comprehensive plans for the work, supervising it and verifying the results, including putting the values on the property, and an analysis of the resulting data into forms which will make them most useful to you. It is my opinion that the Highway Commission ought to be authorized to expend as much as $30,000. for these purposes. The Stone & Webster estimate of the total value of the company's property aggregates substantially $38,000,000., of which a very large proportion is located within this Commonwealth, and $30,000. is a moderate amount to expend for the above enumerated work relating to the appraisal.

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QUESTION 2.

Your second question is:

> Without prejudice to the general problem of what should be the equitable rates for service of the New England Telephone and Telegraph Company throughout its Massachusetts territory, and in the absence of a complete inventory and appraisal of the plant of said company, is it possible to reduce the toll rates now in force in the Boston and Suburban division for toll business into and out from the so-called Metropolitan exchanges, and if such a reduction may be so made upon what basis should it be effected?

A study of the toll rates as they now exist in the Boston and Suburban district between the Metropolitan exchanges and the Suburban exchanges, convinces me that a more equitable adjustment of these rates can be made. In making such an adjustment, it is necessary to take into account a large number of inter-related factors, which enter into the operation, maintenance and investment costs of the different exchanges and the connecting trunks between the Suburban and Metropolitan exchanges.

I believe that any final adjustment of the toll rates between the Suburban exchanges and the Metropolitan exchanges, should be deferred until after a general inventory and appraisal of the telephone properties is made, in case the Highway Commission decides to go ahead with that work; but a tentative reduction of toll rates with the object of bringing them closer to an equitable basis may be made. However, it should be recognized that any change now made is only tentative and is subject to revision after an appraisal of the property has been made and additional traffic and cost records have been obtained.

At the present time, a toll charge of ten cents is being made to points distant less than one mile and one-half from the centre of gravity of the Metropolitan service, and this same charge is being made for messages carried distances up to and including 15½ miles. Distance is not the only determining factor in fixing equitable telephone charges, but other important fac-

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tors like density of traffic and load factors, as far as these can be obtained from existing records, concur in indicating that the existing toll rates are manifestly unfair to the subscribers connected with the Suburban exchanges close to the Metropolitan exchanges.

In my opinion the toll rates paid by telephone subscribers for messages between the several Metropolitan exchanges and the following sixteen exchanges in the Suburban district ought to be at once reduced to five cents (5c) for each five minute conversation: Charlestown, East Boston, South Boston, Cambridge, Chelsea, Roxbury, Somerville, Brookline, Everett, Dorchester, Revere, Winthrop, Jamaica Plain, Brighton, Malden and Medford exchanges. This reduction does not seem likely to be inconsistent with other readjustments of rate schedules which may hereafter be shown to be proper from the information derived from a proper appraisal of plant and from more complete traffic and cost records.

This reduction of toll rates between the Metropolitan exchanges and sixteen Suburban exchanges would, in my opinion, be a step in the direction of equitably adjusted rates, and would, therefore, more acceptably bridge over the time until the necessary information can be obtained for a final rate adjustment. The change would reduce the Boston and Suburban toll rates for all Suburban exchanges within five miles of the centre of gravity of the telephone service of the Metropolitan district from a charge of ten cents for each five minute conversation to a charge of five cents for each five minute conversation from subscribers' telephones. It leaves the toll rates of the Suburban exchanges beyond the five mile radius unchanged.

The Suburban exchanges within the five mile radius cover 18.3 per cent. of the total Suburban territory, they serve 65.6 per cent. of the Suburban subscribers, and take care of more than three-fourths of the total Boston and Suburban trunked calls; while the exchanges beyond the five mile radius cover 81.7 per cent. of the Suburban territory, serve only 34.4 per cent. of the subscribers, and take care of less than one-fourth of the total Boston and Suburban trunked calls.

The average distance the toll messages are carried between the Metropolitan exchanges and the exchanges within the five

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mile radius is approximately 3⅘ miles, computed from the actual lengths of the message routes; while for the exchanges outside of the five mile radius the average message haul is approximately 10⅘ miles. Although the average message haul is only one of the elements entering into the question of equitable rates, it has much influence under the conditions pertaining to the Boston and Suburban district. In all cases of toll charges, the rates are quite properly influenced by distance of transmission, as plant cost is largely determined by it. Short haul, dense traffic may expect to command lower rates than longer haul messages of less traffic density, unless other factors are distinctly controlling.

This change will cause a substantial reduction in the company's receipts. The company does not seem to possess traffic records from which the amount of the reduction may be determined, as the record of paid messages is not separated from the trunked messages originating in Charlestown, East Boston, South Boston and other Suburban exchanges at telephones which pay Metropolitan district prices and consequently do not pay separately for calls to the Metropolitan exchanges. Neither does the company separate public pay station calls from other trunked calls. However, in consideration of the present receipts from Metropolitan-Suburban calls and the effect a reduction of toll rates may have on the selection of classes by new subscribers, it seems obvious that the reduction of receipts will be a substantial figure until the effect of the lower rate is felt in stimulating the traffic.

Question 3.

Your third question is:

> With the same premises as stated in Question 2, in order to improve the quality of the service given by the New England Telephone and Telegraph Company, is it possible and is it advisable to change at the present time the multi-party lines in the Boston and Suburban division to lines having not more than two subscribers thereon with the so-called "divided ringing" appliances?

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The question of limiting the number of subscribers that may be connected to any one circuit is important and deserves careful consideration. As already set forth in my report, the questions of character of service and cost of supplying the service are so inseparably related that one must go hand in hand with the other.

There are at present over thirty-one thousand subscribers receiving telephone service from the so-called multi-party lines (that is, lines for more than two subscribers), most of them being connected to four-party circuits, but over 8,200 being connected to six-party and eight-party circuits. The Company estimates that it would require the addition of approximately 8,000 new subscribers' lines with accompanying exchange office equipment to change all of these subscribers to two-party lines, and that the cost of the required additional circuits and equipment would be $1,000,000, which may be accepted as an outside figure. This estimate is made on the proviso of maintaining the existing ratio of reserve plant, which may be accepted for the estimate, but the Stone & Webster report points out that the existing ratio is high.

The cost of this change of the multi-party lines to two-party lines thus assumes large proportions and the change to new classifications would alter the receipts of the company in an unknown degree. The company now has no data from which to determine equitable charges in the new rates created, and the whole change would be left in the realm of experiment and expediency.

With the present arrangement of lines, each ten subscribers on multi-party lines require 3 3/10 telephone circuits with their accompanying exchange equipment; while under the changed conditions each ten subscribers, making reasonable allowance for reserve plant, would require six and one-fourth (6¼) telephone circuits with a corresponding increase in exchange equipment. This would entail a large increase in the investment and the operating cost per subscriber. There can be no denial that six and eight-party lines contribute an unwelcome part to operating difficulties and make largely for bad service in a large exchange system, and for these reasons should be abol-

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ished. The same is true of four-party lines in business service, but the disadvantages are not so exaggerated. It is my understanding that the telephone company has ceased to quote prices for six-party and eight-party service, and that four-party business service is only quoted in connection with coin-box telephones. The question of the "multi-party" service, therefore, largely resolves itself into, How may the more than 8,200 six-party and eight-party subscribers already obtaining service from the company be provided with a service which reacts less unfavorably on the general service of the system? Over 7,000 of these subscribers are on six-party lines for unlimited suburban residence service at the rate of $25. per annum. The others come into various classes with correspondingly various rates. The traffic data that I have thus far obtained from the Company do not afford a sufficient basis for determining what changes of rates could be made which would result in these subscribers transferring to other classes, and which would at the same time tend toward a general improvement of charges.

It seems to me that it is not desirable to make hasty changes in the "multi-party" line situation. A change to two-party service as proposed by the telephone company is feasible; but such a change involves a complete readjustment of the suburban rate schedules. Such a readjustment at the present time could be effected only on the basis of past experience and business expediency. If your Honorable Body determines to order an inventory and appraisal of the company's property and the keeping of more effective traffic and cost records, I believe that the public interests will be better guarded by gathering the needed data before disposing of this question, as any general re-adjustment of telephone rates in the Suburban district should be made from the platform of equitable charges in each class of service and not only for the purpose of accomplishing a transfer of subscribers from certain obsolete classes. That is, it is my opinion that the "multi-party" line question should be deferred until it can be considered in connection with the broader question of rate readjustment.

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Conclusions.

I will now briefly recapitulate my conclusions:

1st. A properly planned and executed inventory and appraisal of the property of the New England Telephone and Telegraph Company is necessary before any satisfactory solution can be made of the problem of what should be the equitable rates for the service of the company throughout its Massachusetts territory.

2nd. To serve its desired purpose, such inventory and appraisal must be made according to a well digested pre-arranged plan, which will result in sub-dividing the property into its natural operating divisions, and whereby the value of plant will be apportioned so that a distribution of expense depending on investment may be correctly made amongst the different classes of service.

3rd. The Commonwealth should be carefully districted for the purposes of the appraisal, and the property in each district should be listed under headings of the following nature or their equivalents:

Land, Buildings, Central Office equipment, except toll boards, Subscribers' station equipment (Extension telephones and private branch exchange terminal instruments, Other terminal instruments and private branch exchange switchboards), Exchange furniture & fixtures, Other furniture and fixtures, Underground Conduit, Underground Cable for Subscribers' lines, Submarine Cable for Subscribers' lines, Pole lines, Aerial Cable for Subscribers' lines, Aerial wire for subscribers' lines, Tools, Teams, Materials and Supplies on hand, Repair shop equipments, Toll boards, Toll lines distributed as underground and aerial lines and separated from subscribers' lines as accurately as conditions permit, Trunk lines between exchanges (except toll lines) distributed as underground and aerial lines and separated from subscribers' lines as accurately as conditions permit, Private lines, including conduits, cables, poles, etc.

4th. The inventory and appraisal should cover the entire state of Massachusetts in detail, and should also extend over

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the remainder of the territory covered by the company's operations but may be there made in less detail.

5th. Making the property schedules for the appraisal should be placed in the hands of the telephone company, but the plan of the work should be subject to the approval of consulting engineers employed by the Highway Commission, who should keep in constant touch with the progress of the work, checking and verifying it before it is completed. These engineers should also place the values on the property laid down in the schedules, in co-operation with the company and with due consideration of the company's cost records.

6th. The Highway Commission should have at its disposal Thirty Thousand Dollars ($30,000.) to cover their expenses connected with an inventory and appraisal made in the manner recommended in my report.

7th. A preliminary adjustment of the Boston and Suburban toll rates seems to me expedient. This may fairly consist of a reduction of the toll rates between subscribers' telephones in the Metropolitan district and subscribers' telephones in all exchanges within a radius of five miles from the centre of gravity of the Metropolitan telephone service, from ten cents to five cents for each conversation of five minutes' length. The change here recommended apparently will not cause difficulties amongst existing exchange rates, nor is it likely to prove inconsistent with the introduction of revised exchange rates if further study should commend a revision to your Honorable Body; and it is apparently in the direction of equitable rate adjustment. It affects the following sixteen Suburban exchanges: Charlestown, East Boston, South Boston, Cambridge, Chelsea, Roxbury, Somerville, Brookline, Everett, Dorchester, Revere, Winthrop, Jamaica Plain, Brighton, Malden and Medford exchanges.

8th. A change of the "multi-party" line service to two-party service is desirable and should be accomplished for the six-party and eight-party lines at the earliest practicable date; but the means for making the change come essentially into the rate problem, and the change cannot be now effected on

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any other basis than expediency and "what the traffic will bear," and it is therefore my opinion that a general change of this service should be deferred until after the appraisal has been completed and additional cost and traffic data are available.

Respectfully submitted,

DUGALD C. JACKSON.

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EXHIBIT No. 2. — Table showing the number of subscribers on January 25th, 1908, of each Suburban exchange within the five mile radius and of each Suburban exchange outside of the five mile radius, together with aggregate number of subscribers for each set.

Suburban Exchanges within the Five Mile Radius.

Name of Exchange.	Number of Subscribers.
Brighton,	1,225
Brookline,	4,798
Cambridge,	5,239
Charlestown,	904
Chelsea,	1,232
Dorchester,	3,987
East Boston,	967
Everett,	951
Jamaica Plain,	2,355
Malden,	2,006
Medford,	1,012
Revere,	491
Roxbury,	4,294
South Boston,	1,184
Somerville,	3,182
Winthrop,	849
Total,	34,676

Total number of subscribers served by the sixteen exchanges within the 5 mile radius, 34,676

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Suburban Exchanges outside of the Five Mile Radius.

Name of Exchange.	Number of Subscribers.
Arlington,	898
Belmont,	359
Braintree,	321
Canton,	220
Cohasset,	181
Dedham,	592
Hingham,	284
Hull,	115
Hyde Park,	869
Lexington,	505
Lincoln,	123
Melrose,	1,186
Milton,	1,090
Needham,	272
Newton North,	2,245
Newton South,	1,339
Newton West,	1,114
Norwood,	320
Quincy,	1,086
Randolph,	185
Reading,	316
Stoneham,	245
Wakefield,	461
Waltham,	1,359
Wellesley,	598
Weymouth,	373
Winchester,	949
Woburn,	572
Total,	18,207

Total number of subscribers served by twenty-eight exchanges outside of the 5 mile radius, ... 18,207
Total number of subscribers served by the Suburban exchanges, 52,883

Percentage of all Suburban subscribers served by the 16 exchanges inside of the 5 mile radius, ... 65.6%
Percentage of all Suburban subscribers served by the 28 exchanges outside of the 5 mile radius, ... 34.4%
NOTE: — Two Suburban exchanges have been added since 1906.

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Exhibit No. 3.

Trunked Traffic between Metropolitan Exchanges and Suburban Exchanges for Calendar Year of 1906.

These figures are estimated by the telephone company for the year ending December 31st, 1906, and are based on twelve monthly peg counts.

Between Metropolitan Exchanges and —	Miles to Exchange from Metropolitan Centre.	Total Messages In and Out.
Charlestown,	1½	2,028,222
East Boston,	1½	1,241,336
South Boston,	1½	1,620,042
Cambridge,	2½	4,242,686
Chelsea,	2½	990,515
Roxbury,	3	3,522,708
Somerville,	3	1,751,808
Brookline,	3½	3,116,102
Everett,	3½	483,641
Dorchester,	4	2,244,700
Revere,	4	270,461
Winthrop,	4	409,654
Jamaica,	4½	1,539,734
Brighton,	5	747,257
Malden,	5	887,793
Medford,	5	342,835
Total number of messages, between the sixteen Exchanges within the 5 mile radius and the Metropolitan Exchanges,		25,439,494

Note. — The traffic under Exhibit No. 3 includes business originating from the following sources: unlimited exchange service; measured service; ten cent toll charges for use of trunk lines.

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Between Metropolitan Exchanges and—	Miles to Exchange from Metropolitan Centre.	Total Messages In and Out.
Milton,	6	455,512
Arlington,	6½	350,246
Melrose,	7	393,203
Quincy,	7½	651,803
Hyde Park,	8	463,927
Newton North,	8	1,052,441
Newton South,	8	496,035
Newton West,	8	616,622
Winchester,	8	275,391
Stoneham,	9	90,586
Waltham,	9½	676,149
Braintree,	10	146,140
Dedham,	10	306,823
Wakefield,	10	328,433
Woburn,	10	256,929
Hull,	11	93,603
Lexington,	11	127,989
Needham,	11	87,928
Weymouth,	11½	179,304
Hingham,	12	371,355
Wellesley,	12	275,985
Norwood,	13½	188,724
Randolph,	13½	88,795
Lincoln,	14	48,872
Canton,	15	98,307
Cohasset,	15½	130,791
Total number of messages between the twenty-six Exchanges outside of the 5 mile radius and the Metropolitan Exchanges,		8,251,893

Percentage of all trunked messages between the Metropolitan Exchanges and Suburban Exchanges which originate or terminate in the sixteen Suburban Exchanges inside of the 5 mile radius, . . 75.5%

Percentage of all trunked messages between the Metropolitan Exchanges and Suburban Exchanges which originate or terminate in the twenty-six Exchanges outside of the 5 mile radius, . . . 24.5%

NOTE. — Belmont district included with Arlington. Reading district included with Wakefield. The actual message routes are longer than the given distances of Suburban exchanges from Metropolitan Centre.

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EXHIBIT No. 4. — Showing the number of 3-party, 4-party, 6-party, and 8-party lines in service; the number of subscribers served from each class of lines; and the average number of subscribers served per line in each class:

	Number of Lines.	Number of Subscribers.	Average Subscribers per Line.
3-party lines, ...	829	1,451	1.75
4-party lines, ...	7,471	21,982	2.94
6-party lines, ...	1,853	7,152	3.86
8-party lines, ...	231	1,065	4.61
	10,384	31,650	3.05

The average number of lines required for each ten subscribers equals, — 3.28 lines.

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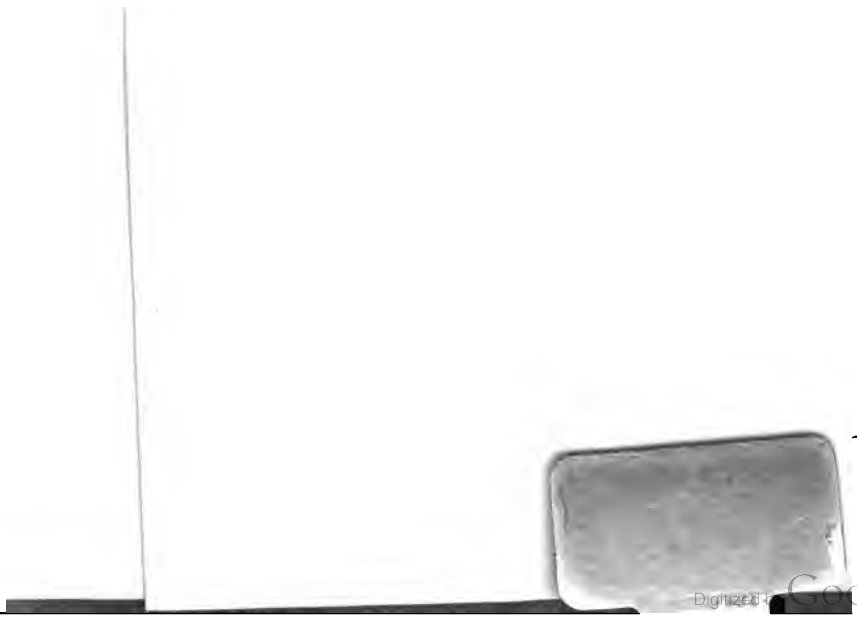
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